## Electronic Supporting Information

Side-chain conjugated polymers for the use in the active layers of hybrid semiconducting polymer/quantum dot light emitting diodes

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Figure S 1.  $^{1}$ H and  $^{13}$ C NMR spectra of compound 1.



Figure S 2.  $^{1}$ H and  $^{13}$ C NMR spectra of compound 2.



Figure S 3.  $^{1}$ H and  $^{13}$ C NMR spectra of compound 3.



Figure S 4.  $^{1}$ H and  $^{13}$ C NMR spectra of compound 4.



Figure S 5.  $^{1}$ H and  $^{13}$ C NMR spectra of monomer **M1**.



Figure S 6.  $^{1}$ H and  $^{13}$ C NMR spectra of monomer **M2**.



Figure S 7.  $^{1}$ H and  $^{13}$ C NMR spectra of compound 5.



Figure S 8.  $^{1}$ H and  $^{13}$ C NMR spectra of compound 6.



Figure S 9.  $^{1}$ H and  $^{13}$ C NMR spectra of compound 7.



Figure S 10. <sup>1</sup>H and <sup>13</sup>C NMR spectra of compound **8**.



Figure S 11. <sup>1</sup>H and <sup>13</sup>C NMR spectra of monomer **M3**.

Polymer characteristics



Figure S 12. <sup>1</sup>H NMR spectrum of polymer P1



Figure S 13. <sup>1</sup>H NMR spectrum of polymer **P2**.



42 -144 -146 -148 -150 -152 -154 -156 -158 -160 -162 -164 -166 -168 -170 -172 -174 -176 -178 -180 -182 -184 -186 -188 -190 -192 -194 -196 -198 -200 -202 -204 -206 δ(ppm)

Figure S 15. <sup>19</sup>F NMR spectrum of polymer a) before and b) after post-polymerization modification reaction. The disappearance of the fluorine atom signals indicates the pentafluorophenyl group replacement with cysteaminemethyl disulfide.



Figure S 16. IR spectrum of polymer a) before and b) after post-polymerization modification reaction. The disappearance of the signal at 1772 cm-1 (corresponding to CO bond) and appearance of the signal at 1663 cm-1 (corresponding to CNH bond) indicates the pentafluorophenyl group replacement with cysteaminemethyl disulfide.



Figure S 17. GPC traces of polymers P1-P3.



Figure S 18. Film absorption spectra of polymers P1-P3. Spin coated from toluene solution.



Figure S 19. Thermal properties of polymers **P1-P3**. a) Thermogravimetric analysis and b) differential scanning calorimetry with arrows indication glass transition area (inset: enlarged glass transition area of polymer **P1**).



Figure S 20. Ultraviolet photoelectron spectroscopy (UPS) spectra of polymers P1-P3.



Figure S 21. Cyclic voltammograms of polymer P1 showing the reversible oxidation of the  $1^{st}$  oxidation peak (a) and the irreversible oxidation of the  $2^{nd}$  oxidation peak (b).

## QD characteristics

Table S1. QD characteristics. a: obtained from TEM images b: Photoluminescence quantum yield (PL QY) was measured using a spectrometer with an integrating sphere (excitation wavelength: 488 nm).

Core radius/schell thickness <sup>a</sup> (nm/nm)	Total radius <sup>a</sup> (R±Std, nm)	PL QY <sup>b</sup> (%)	Ligands
2.0/6.3	$8.3 \pm 0.95$	80	Oleic acid



Figure S 22. a) UV-vis and PL spectra (excitation wavelength 500 nm) in toluene b) TEM image of pristine QDs with oleic acid ligands.

## QD/Polymer hybrid characteristics



Figure S 23. After the ligand exchange procedure the chemically modified QDs acquire properties (i.e. solubility) of the polymer on their surface. QD/polymer hybrids **QH1-QH3** and pristine QDs dispersed in a) hexane (polymers **P1-P3** are not soluble in hexanes) and b) toluene (polymer **P1-P3** are well soluble in toluene). c) shows two phase system (i) hexanes and (ii) o-dichlorobenzene and the respective solubility of pristine QDs with oleic acid ligands in hexanes and the hybrid **QH2** in o-dichlorobenzene. In d) hexanes (i) and o-dichlorobenzene (ii) were added to toluene solutions of QD/polymer blend (**QB2**, polymer used is analogues to P2, however, it has no disulfide functionality, leading to physical QD/polymer mixture), initial **QDs**, and QD/P2 polymer hybrid **QH2** (after the ligand exchange procedure). The initial QDs are well soluble in hexanes and only poor soluble in o-dichlorobenzene. The physical mixture of polymer and QDs does not change the solubility of the QDs in **QB2** and they resume the solubility properties of pristine QDs. The precipitation of the polymer in hexanes can be observed at **QB2**, while QDs remain in the solution. Due to the polymer chains grafted on the surface of QDs in the case of **QH2**, QD in **QH2** acquire the solubility properties of the polymer used and become

insoluble in hexanes and well soluble in o-dichlorobenzene. e) represents the samples from d after centrifugation at 13000 rpm.



Figure S 24. Film absorption spectra of QD/polymer hybrids **QH1-QH3**. Spin coated from toluene solution (1 % wt QD, 1 % polymer).



Figure S 25. An example of the influence of chemical grafting of a polymer onto a QD surface. TEM images of spin coated films of a) physically blended QD/polymer **P2** solution and b) **QH2** QD/polymer hybrid prepared by ligand exchange procedure.



Figure S 26. An example of the retained photoluminescence properties of a QD/polymer hybrid. Photoluminescence spectra of a) pristine QD solution and b) **QH2** QD/polymer hybrid solution in toluene with excitation wavelength of 425 nm.

## Synthesis of colloidal ZnO nanoparticles

ZnO nanoparticles were synthesized based on low-temperature solution-precipitaion method reported in the literature. 3mmol of Zn acetate hydrate was dissolved in 30ml of dimethyl sulfoxide (DMSO). 5mmol of tetramethylammonium hydroxide (TMAH) dissolved in 10 ml of ethanol was dropwisely added in rate of ~8ml/min to ZnO solution and stirred 1hr in ambient air. Then ZnO nanoparticles were precipirated with acetone and redispersed in ethanol at a concentration of ~40mg/ml.



Figure S 27. Energy band diagram of the device, the inset showing the schematic cross-section.